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Estimation of coho salmon escapement in streams adjacent to Perryville, Alaska Peninsula National Wildlife Refuge, 2003

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Key words: coho salmon, escapement, aerial surveys, subsistence, Perryville, Alaska Peninsula National Wildlife Refuge

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Abstract.- Recent runs of coho salmon *Oncorhynchus kisutch* in the Kametolook, Three Star, and Long Beach rivers near Perryville have declined, and residents can no longer meet their subsistence needs in those rivers. Local residents are now taking coho salmon from streams outside the immediate vicinity of Perryville. With fishing effort spread out to other streams, we need to ensure escapement is maintained to meet the subsistence needs of the Native Village of Perryville. In order to prevent over harvest of these small stocks, escapement in those other streams needs to be monitored. In 2003, two aerial surveys were conducted to enumerate adult coho salmon in streams near Perryville using low-level helicopter flights. During the survey in early October, coho salmon were abundant in most streams near Perryville, while few fish were counted during the survey in late November. Weather and local water quality conditions affected the survey interval and effectiveness, and logistic constraints prevented the survey of all areas identified for monitoring. Surveys will be repeated in 2004, but will be scheduled earlier than in 2003.

Introduction

The residents of Perryville depend on fish and wildlife resources for subsistence, and salmon (primarily coho salmon *Oncorhynchus kisutch*) accounts for more than half of the subsistence food they consume (Hutchinson-Scarborough and Fall 1993). The average harvest of coho salmon in the Perryville area from 1993 to 2000 was estimated to be over 1,900 fish, with a range from 993 (1995) to 3,501 (1994) (ADFG 2002). Recent runs of coho salmon in the Kametolook, Three Star, and Long Beach rivers have declined, with escapement estimated at about 200 fish in 1996 (ADFG 1997a). Several reasons for the decline of coho salmon stocks in the Kametolook River drainage have been suggested, including a decrease in carrying capacity resulting from changes in habitat, over fishing in the river, and over fishing in the ocean. Concerns over poor returns and the inability of local residents to meet their subsistence needs in those three systems motivated the Native Village of Perryville to pass an ordinance that prohibits subsistence harvest in the

Kametolook River. In addition, the Alaska Department of Fish and Game (ADFG) engaged in a project in 1996 to rebuild coho salmon stocks in the Kametolook River drainage using incubation boxes, with the intent of improving adult returns by increasing survival from the green egg to swim-up fry stage (ADFG 1997a).

During recent Board of Fisheries and Perryville Subsistence Working Group meetings, local residents stated that they were now taking coho salmon from other streams outside the immediate vicinity of Perryville. In many ways, these streams are similar to streams near Perryville in that they are short, high gradient streams with limited coho salmon abundance. As long as harvest effort is spread among several small streams and harvest effort is not concentrated on one system, the subsistence needs of the village should be met until rebuilding efforts on the Kametolook River become effective.

With fishing effort spread out to other streams, we need to ensure these runs are maintained to meet the subsistence needs of the Native Village of Perryville. In order to prevent over harvest of these small stocks, escapement in those other streams needs to be monitored. The ADFG monitors pink and chum escapement until early September as part of their normal operation, but discontinue aerial surveys prior to the peak of coho salmon runs (Pappas et al. 2003). This escapement information is needed for effective in-season and post-season management of these stocks. This project was initiated to address these coho salmon monitoring needs. Aerial surveys will be used to monitor coho salmon escapement in streams near Perryville.

Study Area

The Perryville aerial survey area is located on the Pacific Ocean side of the Alaska Peninsula, and is entirely within the boundaries of the Alaska Peninsula National Wildlife Refuge (Figure 1). Coho, chinook *O. tshawytscha*, pink *O. gorbuscha*, chum *O. keta*, and sockeye *O. nerka* salmon, Dolly Varden *Salvelinus malma*, and steelhead *O. mykiss* are present in area streams. Streams were selected for monitoring based on consultations with local residents, documented presence of coho salmon from previous surveys (Pappas et al. 2001), and documented use by Perryville residents for subsistence harvest (Hutchinson-Scarbrough and Fall 1999). Streams chosen for coho salmon surveys included (ADFG stream numbers in parentheses; ADFG 1997b): Smoky Hollow Creek (275-40-10200), Wasco's Creek (275-40-10400), Ivanof River (275-40-10600), Humpback Creek (275-50-10200), Red Bluff Creek (273-70-10200), Ivan River (273-72-10200), and an unnamed river in Humpback Bay (275-50-10400; Figure 1). Clark River (271-10-10310-2021) was also included in the survey since it was the site of a nearby monitoring project for which stream walks had proven to be unfeasible (Anderson 2004). Coho salmon escapement monitoring of the Kametolook, Three Star, and Long Beach systems in 2003 was completed using stream walking surveys (Anderson and Hetrick *In review*).

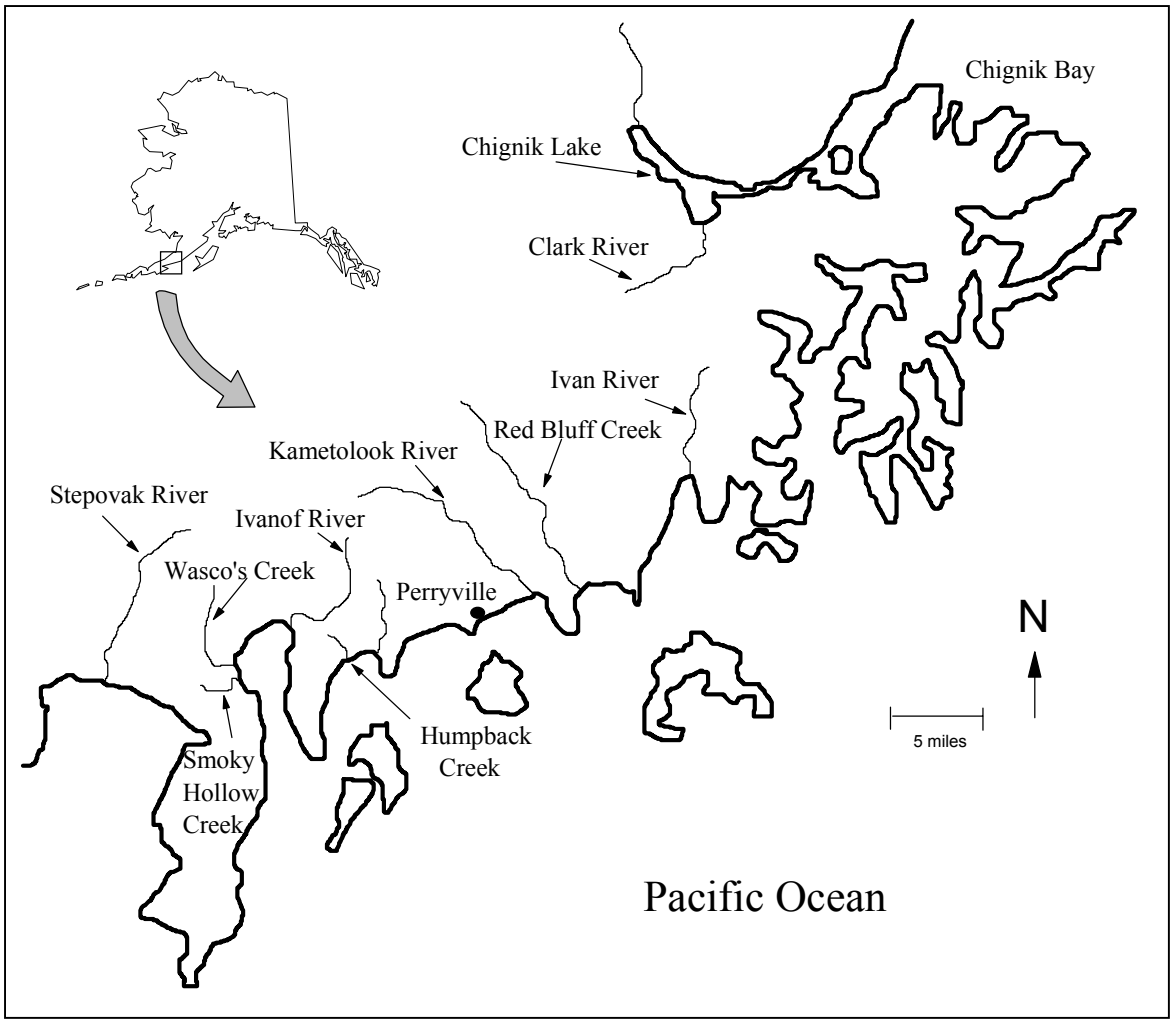

Figure 1. Location of streams in the Perryville area, Alaska Peninsula National Wildlife Refuge.

Methods

Aerial surveys were conducted using low-level helicopter flights. During counts, the pilot maintained the slowest airspeed possible at an altitude ranging from 15 to 50 m above the streambed, depending on the terrain and presence of trees and cliffs. When necessary, the aircraft hovered over large schools of fish and schools with mixed species to assist with the counting. Complete circuits of the study areas were completed either moving upstream from the mouth or moving downstream from the headwaters. Direction of the surveys (upstream or downstream) was dictated by local wind and visibility conditions. Surveys were conducted between 10:00 and 15:00 hours to increase the likelihood of direct overhead sunlight, and polarized sunglasses were worn to reduce glare. Starting and stopping points for each stream survey reach were marked on

topographic maps. During each aerial survey, total numbers of coho salmon and other species observed were recorded for each reach. Lighting conditions (sun, partial overcast, overcast), water clarity (excellent, good, poor), and wind-generated surface turbulence (calm, moderate, rough) were qualitatively estimated for each reach. Locations of large areas of coho salmon spawning activity, and large congregations of migrating or staging coho salmon were noted, as were locations and numbers of active fishermen.

Two stream surveys were planned, one in early October and one in early November, and were scheduled based on weather forecasts and local stream conditions. Flights were coordinated to minimize sampling error by avoiding periods of turbid flow and inclement weather. The first survey was completed during 10 and 11 October 2003, and the second survey was completed during 21 and 22 November 2003. Due to logistic constraints (fuel and available funding), entire watersheds were not surveyed. Generally, mainstem rivers and major tributary streams were surveyed until they began branching into numerous small tributaries, or until the vegetation canopy limited the ability of observers to count fish. Survey reaches are considered to be index areas, and counts are considered minimum estimates of coho salmon abundance. Our assumption is that periodic aerial counts will provide a minimum index of coho salmon escapement.

Results

Large numbers of coho salmon were observed during the aerial survey in early October 2003, but few were observed during the November survey (Table 1). More coho salmon were observed in Red Bluff Creek than in other systems, and more sockeye salmon were observed in the Clark River than in other systems. It was not possible to differentiate pink salmon and Dolly Varden from the air, so counts for these species were combined and classified as "Other". Most coho salmon observed in October were staged in large pods and not actively spawning, while most observed in November were paired-up and actively spawning. With few exceptions, surveys were conducted when lighting, water clarity, and surface turbulence allowed for good visibility of fish in the streams.

Two main branches of the Ivanof River were surveyed in 2003 until the canopy limited our ability to see the stream (Figure 2). Humpback Creek (Figure 2) was also surveyed until the canopy limited visibility. The unnamed river in Humpback Bay (Figure 2) was surveyed until stream size progressively decreased, and it split into two small tributaries. The mainstem of Red Bluff Creek and its major tributary (Figure 3) were surveyed until the canopy enclosed the streams. The mainstem Ivan River (Figure 4) was surveyed until it became a series of braided, intermittent channels. The mainstem Clark River (Figure 5) was surveyed until it branched into two smaller tributary streams with little flow. Coho salmon may have been present in smaller tributary streams that were not surveyed. However, due to logistical constraints (primarily fuel supply), these smaller streams were

Table 1. Numbers of fish observed during aerial surveys for coho salmon in streams near Perryville, 2003. CO = coho salmon, SE = sockeye salmon, and Other = either pink salmon or Dolly Varden.

Stream	October Survey			November Survey		
	CO	SE	Other	CO	SE	Other
Wasco's Creek	[a]	[a]	[a]	[a]	[a]	[a]
Ivanof River	2,600	0	600	314	74	600
Humpback Creek	60	0	0	2	0	0
Unnamed River, Humpback Bay	1,120	4	300	14	0	0
Red Bluff Creek	5,000	0	1,700	330[b]	6[b]	0[b]
Ivan River	2,150	200	300	217	0	300
Clark River	900	6,100	200	300	9,700	200

[a] Survey not completed due to poor water clarity.
[b] Mainstem Red Bluff Creek was not surveyed due to poor water clarity. Survey numbers represent count in the East Fork.

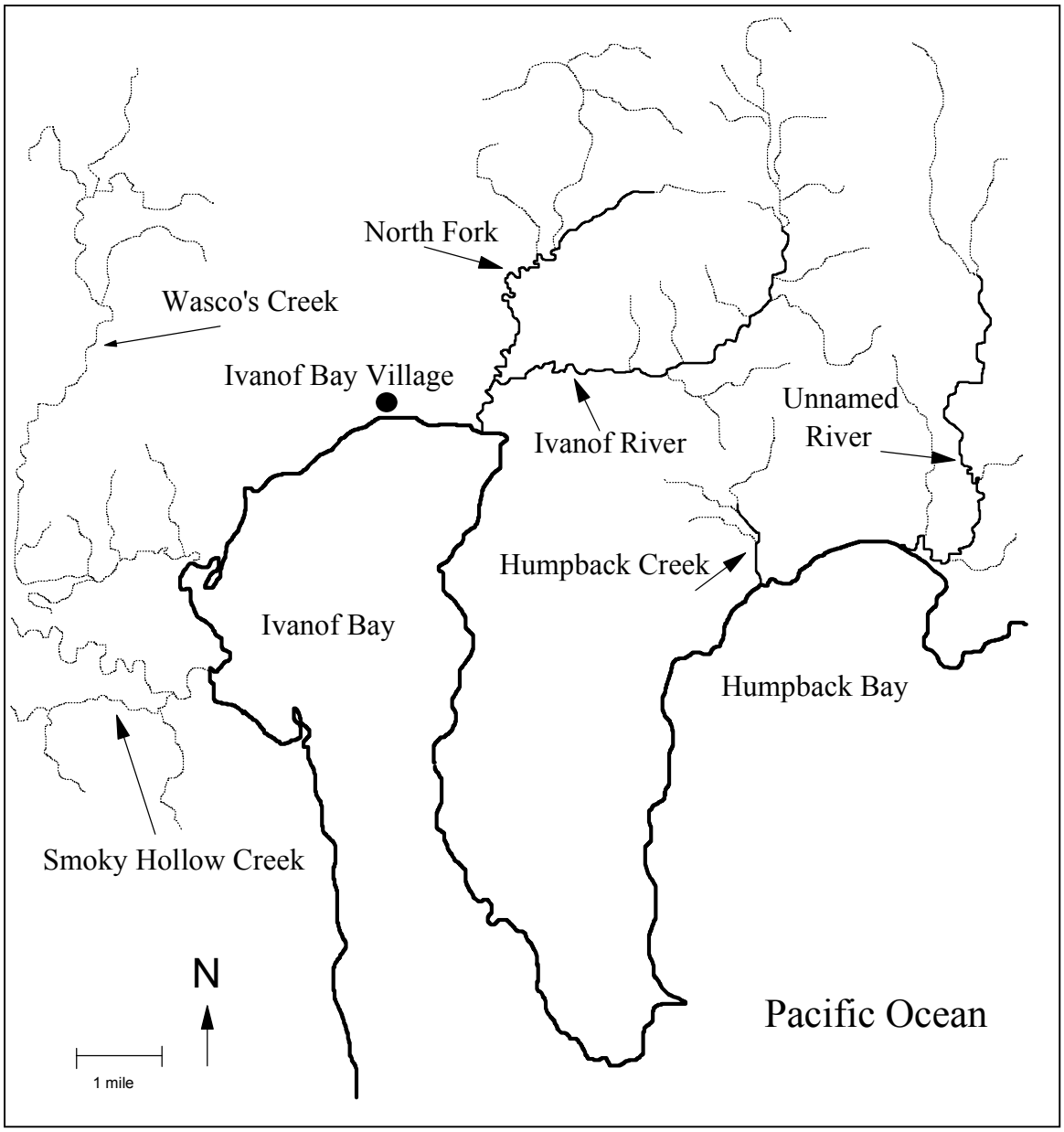

Figure 2. Ivanof and Humpback Bay survey areas, Alaska Peninsula National Wildlife Refuge. Streams shown with dashed lines were not surveyed.

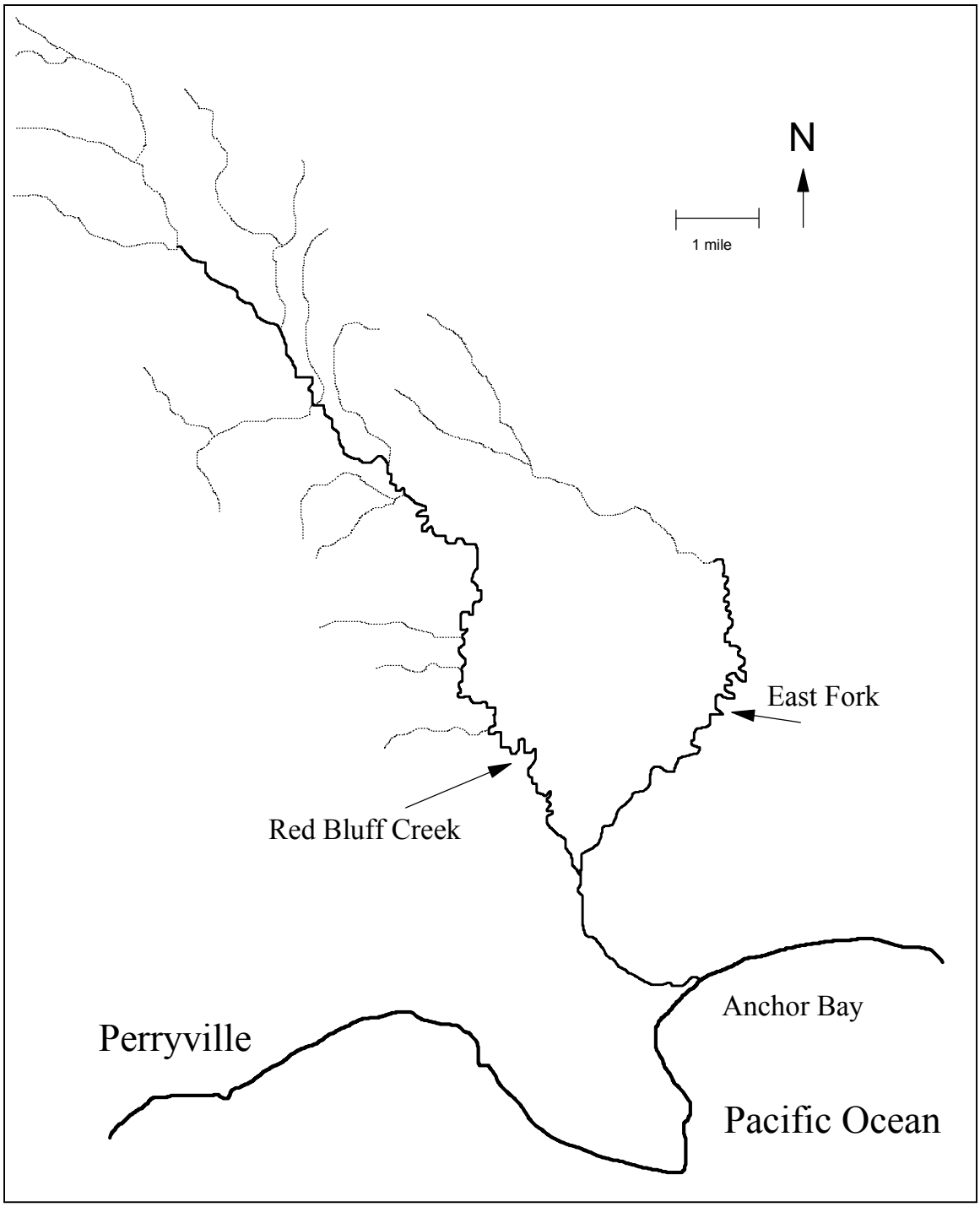

Figure 3. Red Bluff Creek survey area, Alaska Peninsula National Wildlife Refuge. Streams shown with dashed lines were not surveyed.

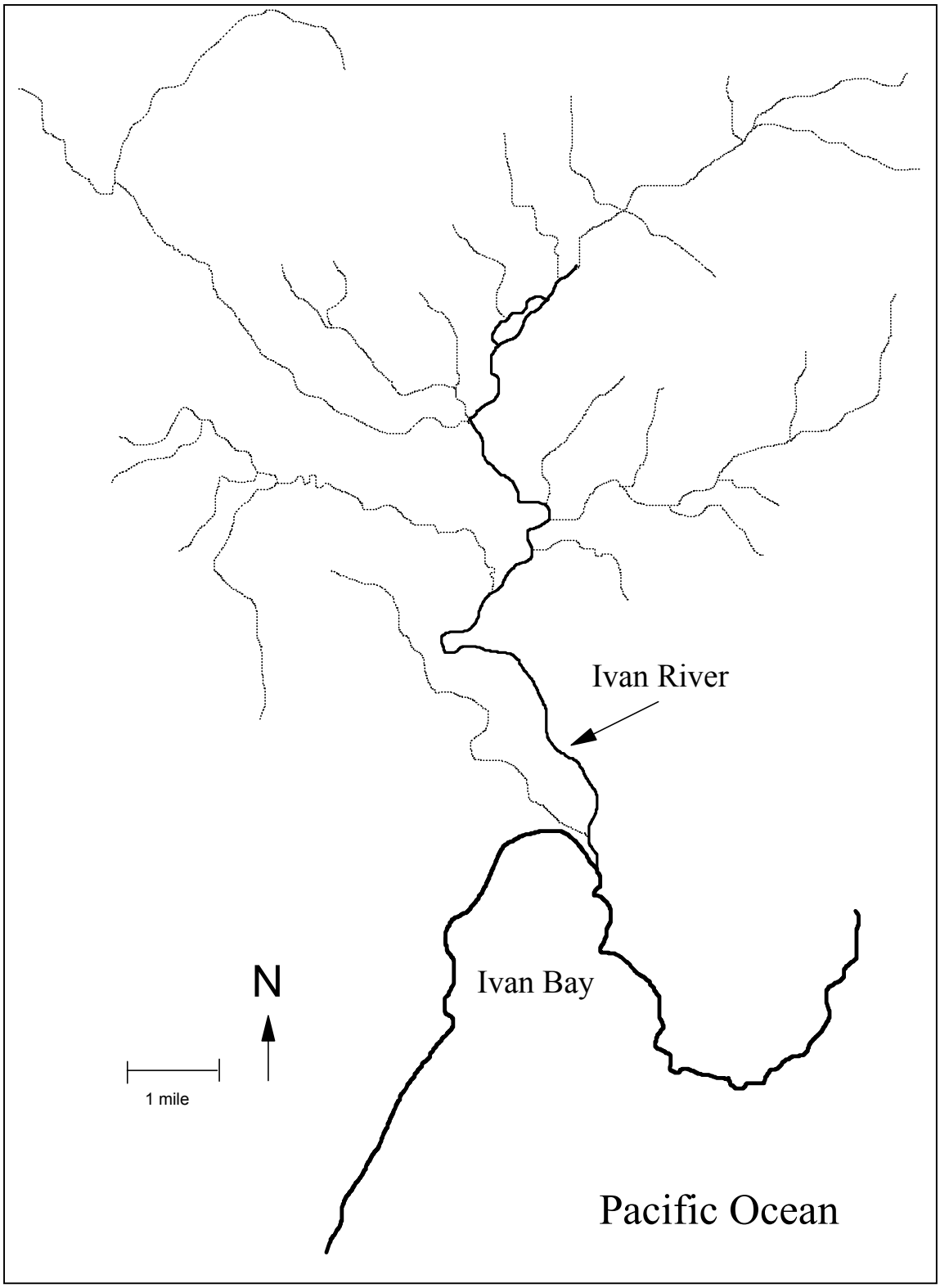

Figure 4. Ivan River survey area, Alaska Peninsula National Wildlife Refuge. Streams shown with dashed lines were not surveyed.

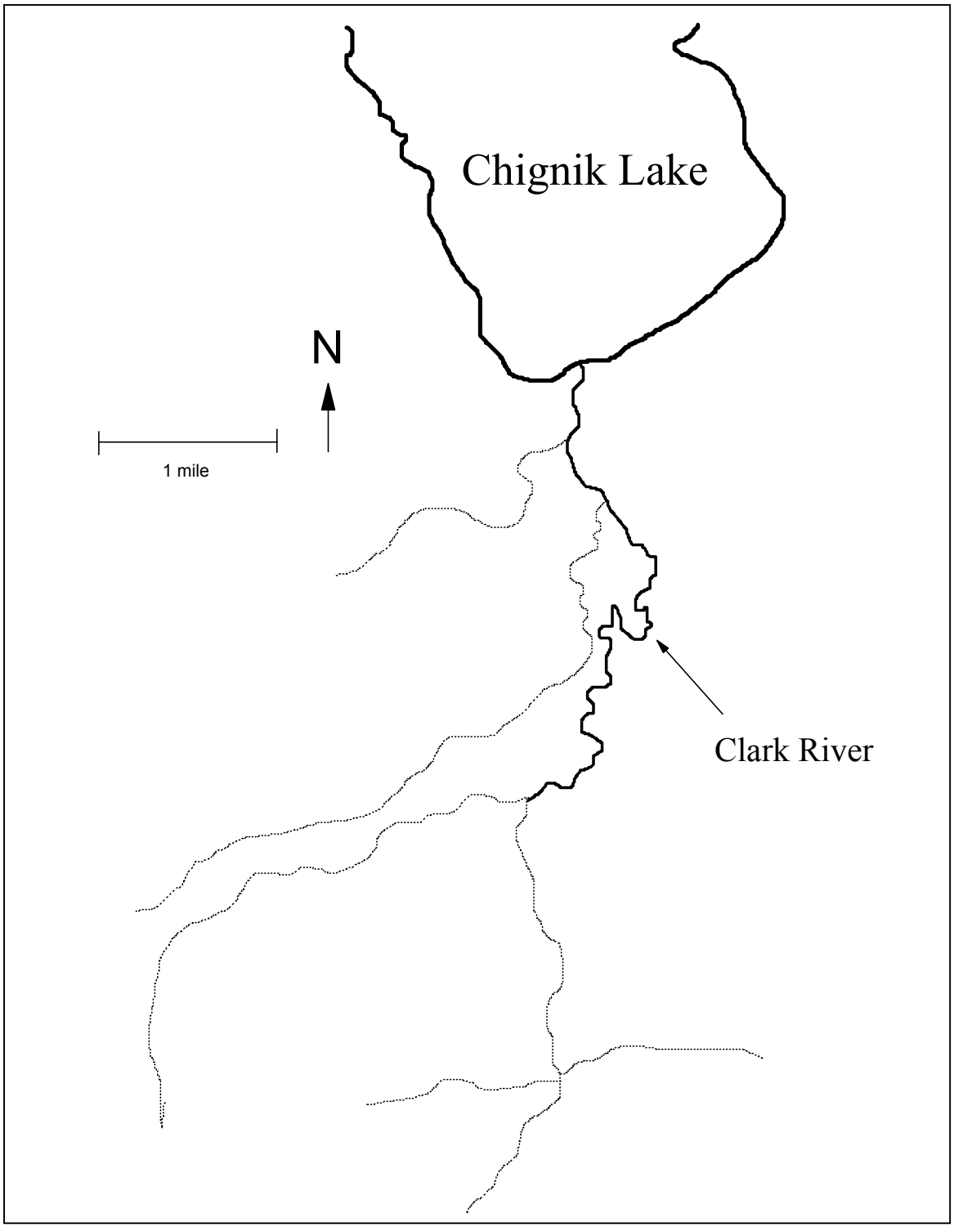

Figure 5. Clark River survey area, Alaska Peninsula National Wildlife Refuge. Streams shown with dashed lines were not surveyed.

not surveyed. As entire drainages were not surveyed and count intervals were not adequate for expansion to area-under-the-curve estimates, surveys should be considered index counts of coho salmon abundance for a given stream reach and survey period, and not estimates of total abundance.

Discussion

The October survey should provide a reasonable index of coho salmon abundance for the surveyed reaches, although it is possible that coho salmon could have entered the systems, spawned, and died between survey periods. Perrin and Irvine (1990) report an average survey life for coho salmon of 11.4 days, which was compiled from 22 separate estimates throughout the Pacific Northwest and Alaska. Hetrick and Nemeth (2003) determined an average stream life for coho salmon of 13.7 days for coho salmon in a small stream on the Alaska Peninsula during October and November. Both estimates suggest that coho salmon may have entered, spawned, and died within study systems without having been observed during our surveys. Survey life for Pacific salmon can vary among and within streams and years (Perrin and Irvine 1990; Bue et al. 1998), so effects of the long interval between our surveys in 2003 are unknown.

Weather and water conditions affected the aerial surveys in 2003. In both survey periods, poor water clarity in Wasco's Creek prevented enumeration of fish, and poor water clarity prevented surveys in mainstem Red Bluff Creek in November. The November survey also occurred much later than was planned due to weather conditions. Attempts were made starting on 3 November to complete the second survey, but a suitable weather window did not allow for the completion of the survey until late November. Surveys in future years will be scheduled earlier. The first survey will be attempted starting on 1 October, and the second survey will be attempted starting in late October instead of early November.

Stepovak River and Smoky Hollow Creek were not surveyed in 2003 due to logistical constraints. In 2003, surveys were based out of Chignik Bay, on the eastern edge of the survey area (Figure 1). This was primarily because of convenience and the availability of fuel at one of the local canneries. In future years, it would be beneficial to have a fuel supply available in advance in Perryville, a more centralized location. That would eliminate travel to and from the survey area and Chignik Bay to refuel, and would allow adequate aircraft range to survey streams in Stepovak Bay and Smoky Hollow Creek.

Although not a total spawning escapement estimate, index counts can provide valuable information to area managers. The major flaw of an index count is that it provides a single number with no measure of precision, i.e., it does not include sampling variation. The fundamental assumption is that index counts represent a constant proportion of the true counts across time. In general, the usefulness of any population survey depends upon obtaining unbiased, or nearly unbiased, and precise parameter estimates in a cost-efficient, logistically feasible manner (Thompson et al. 1998). Due to the inclement weather and “flashy” nature of the streams in this region during late fall, getting a more

precise estimate of coho salmon escapement is neither logistically feasible nor cost effective.

Acknowledgements

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